Superconducting RF Activities

Overview-

3.9GHz on going work- CKM and 3rdHar

FY05...

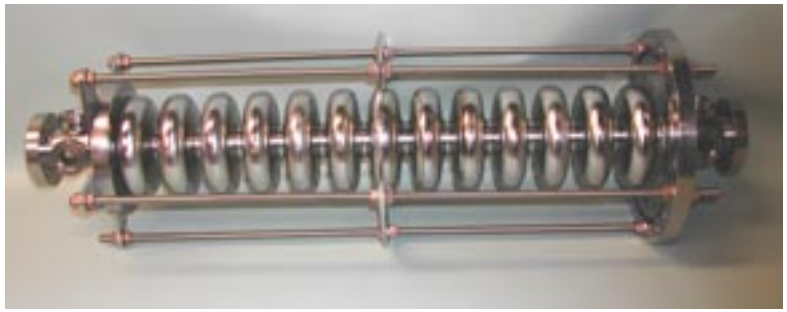
DOE HEP position

Issues-the big and the small

TTF collaboration-3rdHarmonic

SCRF R&D for LC and other

Superconducting Cavity Development
Beams Div & Tech Div



3.9GHz CKM deflecting mode cavity for Kaon separated beam line

- For beamline ~16 cavities needed

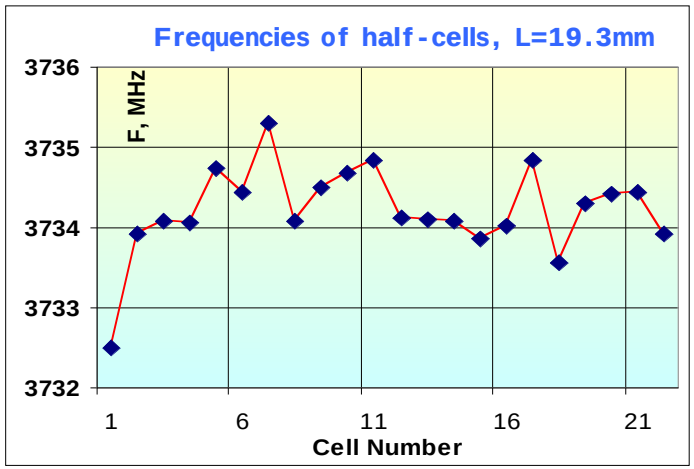
- Fabrication of full prototypes (9-13 cell)
- Total 7 cavities built: three 1cell, one each 3, 5, 9, 13cell
- Vertical dewar tests of 1& 3 cell- most test runs on 3cell (7)

- Next- prototype Horiz Cryostat
- Chemistry at Argonne critical path

Superconducting Cavity Development
Beams Div & Tech Div

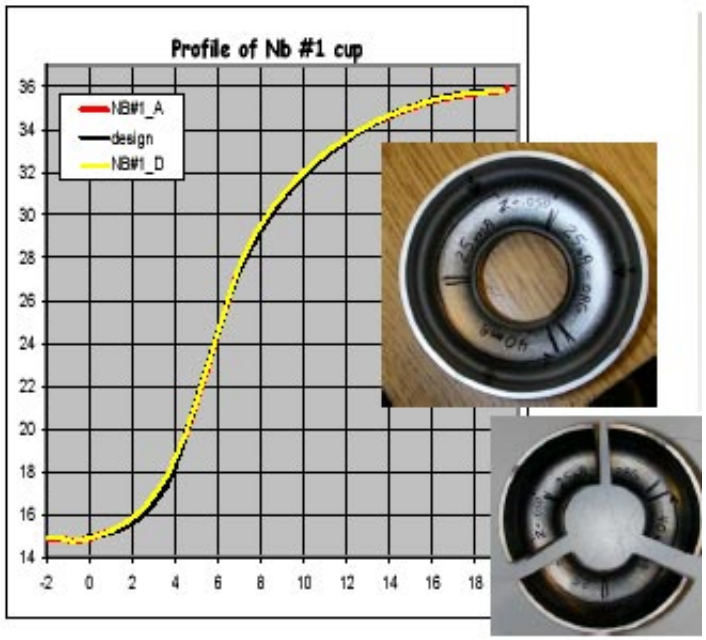
3.9GHz 3rdHar

- accelerating mode cavity for linearization of 1.3 GHz rf for use with long beam bunches
- Cu model cavities & HOM coupler under fabrication
- Next-RF Measurements of HOMs and cavity models
- Nb prototype cavity



Half cell freq measurement
Δ ~1MHz

Shape measurement



CKM cavity measurements

Most of measurements done with 3 cell
•7 sets of measurements over 1 year

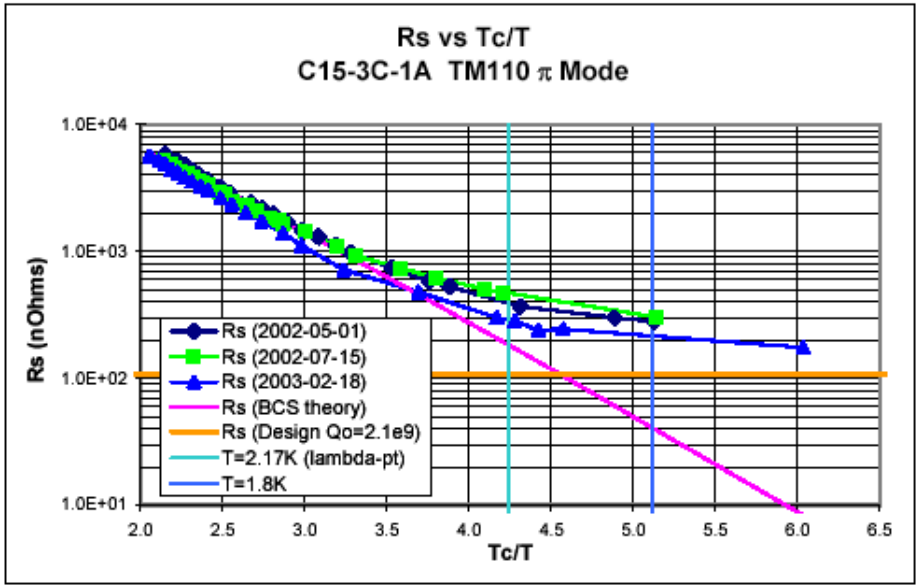
•Q vs E started at 5.1MV/m but has decreased to 3.4-3.7 Design is 5MV/m- equivalent to about 21MV/m in acc mod

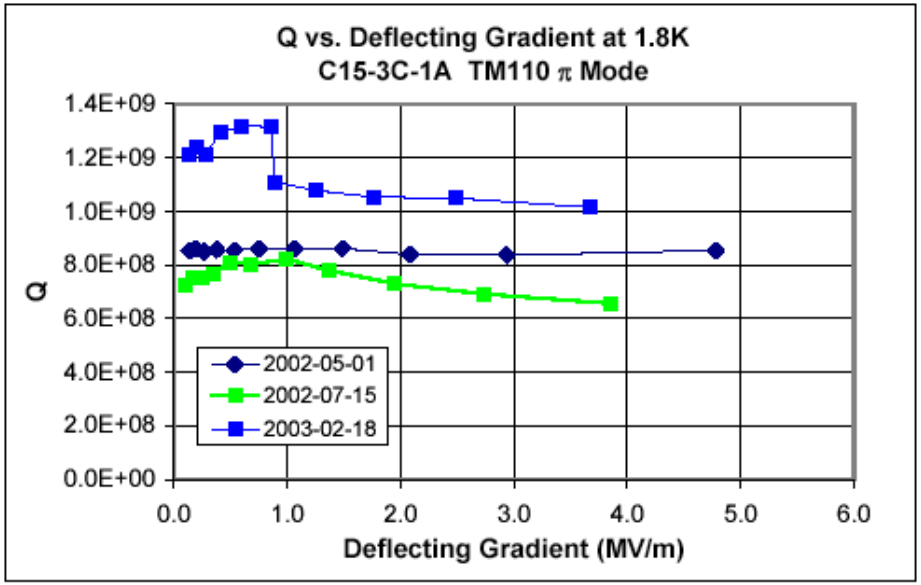
•Q vs T has been a main focus- Rs is higher than expected. Part of this is due to too short beam tubes when changed from 30mm to 36mm diameter.
•Recent measurement of Rs ~170 nOhm Design goal is about 100 nOhm

•Other measurements
temperture to detect quench locations
vibration and piezo sensor

•Critical Path- We must get our chemistry going with Argonne

C15-3C-1A





Schedule Goals - CKM R&D

FY03 Acid etch at Argonne (existing facility)

Test cavities Vert Dewar- 3cell and 13 cell

fabricate cavities

(1)Start prototype cavity system-module and RF (a two cavity module with 1 real cavity), w input coupler,tuner, helium vessel, etc

assemble RF system-high and lowlevel

Start chemistry facility at Argonne

FY04 Continue cavity fab and test

Finish and test 1st cryo module. Systems test- cavity, rf cryo

(2)Start FNPL 1 cavity module-Start fab of 1 cavity cryo module for FNPL injector test

Beam Test Install & Start tests at FNPL injector of 1 cavity module

FY05 Industrial procurement of cavities (if not in 04)

Continue test program

Continue systems tests with beam of 1 cavity module

(3)Construct and test final 2 cavity prototype module and systems

Begin preliminary Cryo plant effort

Future? FY05 and Beyond

•3rdHar

Install and use a 3rdHar cavity at FNPL for linearization of the RF field with long bunches

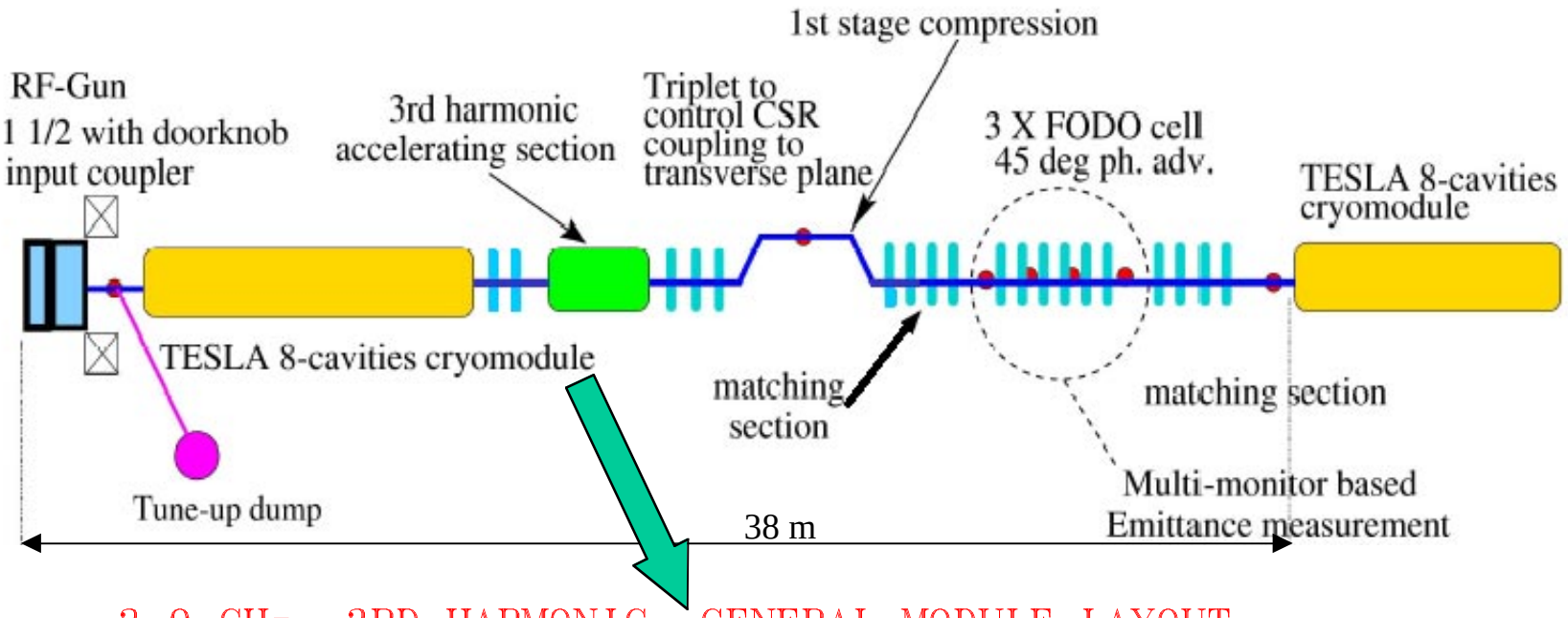
Collaboration on TTF - production of a 4 cavity module for short bunch compression This are essential to obtain best 6D phase space & FEL saturation at ~6nm

• Continued collaboration with DESY on SCRF , injector development, low emittance beams, beam diagnostics. This connection is essential the health and productivity of our photoinjector program to maintain critical mass

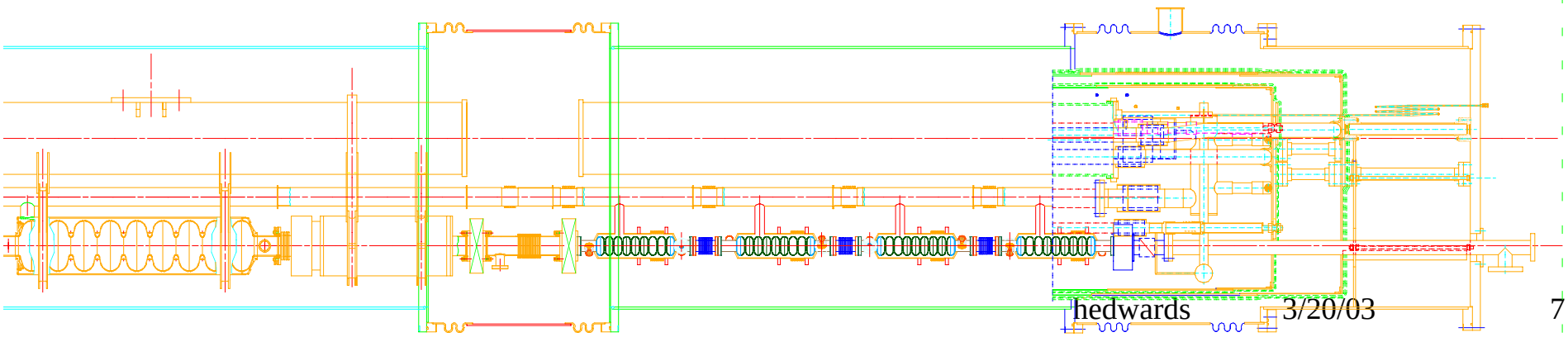
• FNPL-future?

Out grow A0 building? >> higher energy & brightness injector >100MeV (HBPI) -TESLA module(s), cold LC linac (and other linac applications) test bed, low emittance beam and AARD experiments at higher energy, further student training and experience with scrf technology, R&D, and engineering. DESY has offered a cryo module

TTF Injector III with 3rd Harmonic Cavities



3.9 GHz, 3RD HARMONIC, GENERAL MODULE LAYOUT



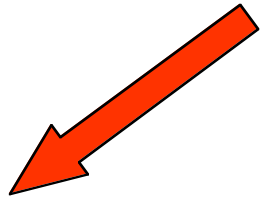
Report on 1997 DOE Review of Fermilab activities (1998)

"Fermilab's attitiude toward the Stanford Linear Accelerator Center-based activities concerning the Next Linear Collider (NLC) remains rather passive. At the annual review we heard virtually nothing on possible Fermi/SLAC collaboration on NLC. It is difficult to comprehend why Fermilab is more cooperative with a foreign-based electron-positron collider proposal than it is with a similar one based in the United States."

Guidance to university groups on LC R&D proposals (2002)

"The scientific and technical topics proposed should a) be generic in that they deal with a topic of importance to all linear colliders, or b) be specifically applicable to the U.S. entry in the linear collider sweepstakes, the warm rf Next Linear Collider. Topics that duplicate R&D in the area of, or related to, superconducting rf preformed for the proposed TESLA linear collider, or its upgrade, will not be considered at this time!"

DoE's Financial Plan Guidance to Fermilab (2003)



"Funding in the amount of $5,900,000 is provided under KA-15-02-01 for generic research into advanced accelerators including advanced superconducting magnets for use in accelerators beyond the Tevatron, but not to include any R&D funds for superconducting 3.9 GHz RF accelerating cavities."

The Big and the Small Issues

The Big Issues

•The US needs to evaluate LC technology in an unbiased and educated manner- this should include getting experience with the technology

•A LC will be an integrated international collaboration- We should be open to collaborations on future acc R&D now

•Superconducting RF is an enabling acc technology of the future- it is of value not only to HEP but NP and BES- DOE should have an integrated approach (not a stovepiped approach) to successfully carry out coherent basic acc R&D

•The US should be encouraging development of industrial scrf capability

•The FNPL injector and scrf activities at FNAL are on a small scale- should not FNAL have some self determination on its R&D for its future?

The Small(er) Issues

- The 3rd Harmonic 4 cavity Module for DESY

- Continued injector collaboration with DESY on low emittance beams, flat beams, gun development, etc. (Fermilab has had a history of no acc R&D except that directly applicable to near term operations.) FNPL is an attempt to establish an acc R&D program for the future, and for student training

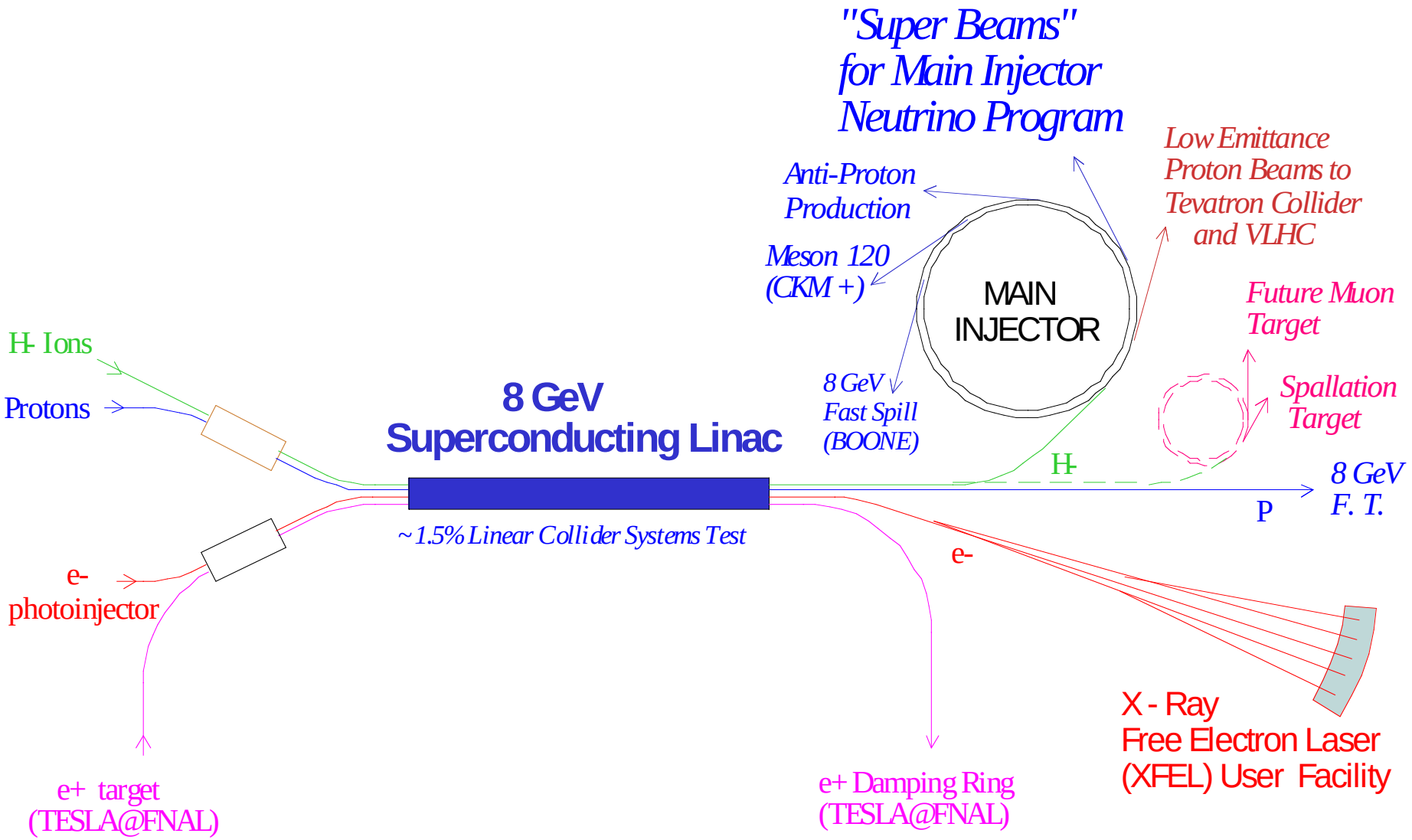
- The future? (a LC or....?)

SCRF enabling Technology- CKM, Proton Driver, LC (Fermilab long range)
If we are serious about scrf- we (US labs) should start to do some serious R&D in collaboration with DESY and other international labs.

- A test string like an increased energy hi brightness photoinjector(HBPI)

-Tesla LC and/or Proton Driver linac systems test area
-development of low emittance beams,
-scrf research into better preformance cavities,
-scrf systems integration and operational test bed.

Multi-Mission 8 GeV Injector Linac



Why more SCRF at Fermilab?
or for that matter in the US.

Yes- one does not want to duplicate R&D,
but one must walk before one runs
There needs to be some long term dedication to an R&D program
in order for it to have success

- If a LC-then it is a good candidate
- If not an LC then it is still a good future technology
- DESY will be working hard on engineering a project design and industrialization- Real effort and resources that will be directed to this technology
- DESY focus must be toward their project- Other advances, research, and prototype advances, systems and life testing can and need to be done elsewhere.
- TTFII is a light source for a user community- not an acc R&D test bed
- There needs to be as much operational experience and life testing of the SC integrated systems as possible if one is serious about a LC.

Why ~100+MeV injector at Fermilab?

Conclusions

There is a small scrf effort underway at Fermilab
This effort should lead to cavities for FNPL injector, CKM and TTFII

The technology has great potential for future accelerators
The US (and FNAL) should be part of this developing technology
for LC, FEL and/or Proton Driver application

Beyond the present activities we should be looking toward the
possibility of a ~100MeV injector that would allow for
"string testing" of prototype modules & systems
systems development, operation, and life testing
and accelerator development of high brightness beams

If we want to be serious about cold LC technology we better start